Sociality and electricity: the influence of household dynamics on everyday consumption

Abstract:

Our paper investigates household practices that use electricity, their relation to systems of provision and the enactment of domestic sociality. The results of this research conducted in the UK shed light on puzzling variations in electricity consumption across households posed by previous research. We argue for the need to attend to how household socialites influence and are influenced by electrical services and trace the links between these dynamics and the effects of wider cultural and socio-economic forces.

Keywords:

electricity, energy practices, consumption patterns, UK

1. Introduction

In the UK technology continues to take centre stage in government and industry strategies intended to achieve changes in patterns of domestic electricity consumption towards using less electricity altogether or to reduce critical peak loads at certain times of day. Providers and government agencies dispense advice about how to operate systems or appliances to optimize efficiency, and reduce peak demand, for example, buying an energy efficient washing machine, using an economy or low temperature wash programme, and running it at night-time. A range of time based rates are offered including time-of-use tariffs, critical peak pricing, and real-time (dynamic) pricing that seek to promote customer demand response based on price signals.

The authors of these technical and economic artefacts fail to recognise the socially shared and co-ordinated domestic practices that constitute residential electricity consumption. In this paper we argue that reducing domestic electricity consumption or encouraging customers to move their consumption away from periods of peak demand, such as early evening, is less a technical challenge and more a matter of understanding and responding to socio-cultural practices within and across households. Variations among households, such as income and house tenure are

important factors, but when considered alone they are too crude to be indicators of customers' willingness and ability to use less electricity and to time-shift their consumption to release pressure on generation and distribution during intensive peak periods (Powells et al. 2014) or towards times when fluctuating renewable generation is high (Goulden et al. 2014).

We take the view that members' positioning in relation to one another, together with interactions between them and between members and their physical surroundings, shape practices in which electricity is embedded. Our focus here is on understanding households as collective enterprises that are fabricated through patterns of everyday routines and interactions that entail the consumption of electricity.

Greater knowledge about what members of households do every day and a better understanding of the influences that shape household practices are required to inform effective policies and interventions aimed at reducing domestic energy consumption (Gram-Hanssen 2014). Although measuring energy use is important to quantify the dynamics of household consumption and how this might change, such metrics need supplementing by knowledge about practices in which electricity is embedded, their relation to systems of provision and connection to the enactment of sociality in households. We treat the household as a micro-level energy system - with specific logics and modus operandi – connected across its permeable and historically changeable boundaries to larger economic and social systems (Wheelock and Oughton 1996). We adopt a socio-technical perspective that views the electricity system as a seamless web (Hughes 1986), which reaches deep into people’s domestic arrangements. The services electricity provides help structure the social organization and activities of household members and are integral to household management. By virtue of electrical power domestic chores, food preparation, personal care, laundry, recreation, media consumption, modes of communication and perceived levels of comfort are mediated through appliances that become normative and indispensable items for organising and sustaining household sociality.

In studying pro-environmental behaviours social scientists envisage society as constituted at different scales understood as macro, meso and micro levels. Studies at the macro-level are characterised as “having a central concern with the overall system, making it ‘top down’ analysis

in research and policy making" (Reid et al. 2010:310): while micro level studies tend towards behaviouristic models linked to the attitudes and motivations of individuals. The middle or meso-level of reality, where the household is positioned, brings the macro and micro levels together in a way that provides "both a frame for viewing the world and is simultaneously constituted by the processes and interactions within it" (Reid et al. 2010:315). This frame is valuable for considering contemporary forms of energy consumption that extend across multi-scalar networks linking individual users to distant sources of generation. The electricity network load, for example, is the aggregation, at different scales, of the multiple ways in which electricity is used across the distribution network. (Powells et al. 2014).

Theories of social practice - socio-cultural accounts of the practical undertakings of everyday life - embrace multi-scalar perspectives and are influential in revealing people's relations with material technologies. As it evolved in recent years practice theorists stressed the inclusion of material factors as one of several key elements that constitute a practice, or associated clusters of practices (Warde 2005; Gram-Hanssen 2011). Consumer studies provided new insights about the conditioning power of multiple social and cultural processes in maintaining stability or creating changes in people's recruitment to and defection from practices, leading to a more social constructivist version of practice theory (Halkier et al. 2011). We employ that perspective to focus on how household sociality influences and is influenced by electrical services and how social dynamics, specifically those relating to gender, age generation and household fluidity, connect to wider cultural and socio-economic forces

1.1 The Customer Led Network Revolution Project and Methodology

The data for this paper derives from visits to the households of 131 domestic customers that formed part of The Customer-Led Network Revolution (CLNR) project in the North East of England.[1] The project embraces a range of research activities such as power system monitoring

[1] It is one of several 'smart grid trials' that seek to understand current and likely future energy demand, and the potential for fostering customer flexibility. Funded by Ofgem (the UK's energy regulator) under the Low Carbon Network Fund (LCNF), the project is led by Northern Powergrid, the Distribution Network Operator (DNO) for the Humber, Yorkshire and North- East region of England, together with British Gas, one of the largest energy retailers in

of thermal and voltage ratings, the collection of consumption data, and a survey of British Gas domestic customers. Only data from the qualitative research with British Gas customers is discussed here. This qualitative research addressed the two main learning objectives of the project: to understand how people currently use electricity and to assess households' capacities to develop flexibility through a range of interventions, for example by volunteers accepting time of use tariffs and others accepting direct control of wet white goods. Some work based on these objectives and relating to direct interventions has been published (Powells et al. 2014).

In this paper we examine issues pertaining to gender, generation and household fluidity. These topics arose through the processes of research and analysis, even though they were not directly addressed at the planning stage. We did not, for example, ask questions about which members of households performed which domestic tasks, but enough people raised them by their own volition to command attention. Similarly we did not start off by framing questions concerning the effects of economic recession leading to concerns about the increasing costs of electricity consumption relative to income and alterations in household composition. Our informants alerted us to their importance. These unexpected elements signalled the relevance of household dynamics and composition across time. They surfaced through researchers employing a semi-structured interview guide that allowed interviewees to raise unforeseen concerns.

Interview appointments were arranged with a single member of the household who opted into the research project after initial contact from either their energy supplier, British Gas or from a clustered group of recruited through their social landlord, South Tyneside Homes. Research visits were conducted as socio-technical home tours in which participants were encouraged to guide researchers through their homes from one site of energy use to another. A feature of these tours was that other members of the household, and sometimes neighbours would participate in the conversation as new domestic practices and spaces were encountered. As a result many research visits featured multiple voices. The majority (68%), of household types interviewed were classified as ‘”couples” or “family” with two or more members. Nearly half of

the UK, EA Technology Limited, Newcastle and Durham Universities. For more information about the project see http://www.networkrevolution.co.uk

our respondents (45%) stated they were retired, 24% working, 12% mixed (working/mixed duties), 5% unemployed, and 14% of informants refused to share the information (unassigned). Household income sources ranged from one member being in receipt of state benefits to households with two executive incomes. Retirees in the study ranged from those with just a state pension living in socially rented accommodation through to owner-occupier couples with significant private pensions.

The interviews were followed by a home tour to record how different rooms were used. Home tours are increasingly popular as a method for researching energy practices and are recognised as a valuable mechanism for engaging participants with technologies and other material features in their domestic settings and for eliciting context sensitive and socio-technically attuned responses (Pink 2011; Hargreaves et al. 2010). The home tour was concluded with a further wide-ranging conversation about households' current and possible future relationship to electricity use.

1.2 Variability in Energy Use: Occupants Shaping Demand

Evidence from empirical studies demonstrates significant variation in all forms of energy consumption between households. Variation is a consistent theme in energy studies at least since the 1980s (Lutzenhiser 1993). Large degrees of variability in energy consumption have been observed, with higher consumers using between two and four times the amount of energy lower consuming households use, even for demographically similar families living in similar homes (GramHanssen 2010; Guerra-Santin et al. 2009; Steemers and Yun 2009). In terms of total electrical energy consumption, Firth et al., 2008 found that households with highest levels of demand use over nine times as much electricity as households with lower electricity demand while Hackett and Lutzenhiser (1991) observed demand varying up to 300% between identical homes in apartment complexes in California. In the UK context, an in-depth case study of 26 dwellings of uniform construction in the UK concluded that 37% of the variation in electrical consumption could be explained by occupants' behaviours (Gill et al. 2010).

A number of reasons are proposed to explain variation in electricity consumption. Social theory and previous research suggest that household overall energy use is structured by household composition/dynamics, status-appropriate dwellings and appliances, and lifestyle-based behavior patterns (Lutzenhiser and Bender 2008). Household electricity use is found to be strongly, but not solely, related to income levels (Yohanis et al. 2008; Druckman and Jackson 2011). Using statistical regression analyses, Gram-Hanssen et al. (2004) show that household size can account for 22–35% of the variation in electricity consumption when homes are grouped into broad dwelling types but other socio-economic features of household composition (age, income, education) only account for a small degree of the remaining variation. Two thirds of the variation in electricity consumption cannot be explained by socio-economic variables (Gram-Hanssen et al. 2004). A study by Vringer (2005) found a correlation between energy use and income but as the bandwidth of energy use is substantial within the same income category, not all variation can be explained by income. Thus, whilst income and socio-demographic characteristics can explain some consumption of overall energy use, and of electricity in particular, these factors do not fully explain variation.

The significance of increased amounts of electrical appliances and the ways they are used appears in several UK studies, for example Firth et al. (2008), and Yohanis et al. (2008). An in depth end use monitoring study recording appliance consumption data for 400 households in Sweden (Bennich et al. 2009) shows considerable variation in individual household consumption for different appliances, and the authors identify a need for further analysis of how household use their appliances, including how members interact with each other. The type of space heating (or cooling) influences electricity consumption; overall average consumption in UK households is higher where electricity is a primary or additional source of heating rather than gas.

Empirical studies suggest that patterns of energy consumption vary across the life cycle, between ethnic groups and cultural norms such as acceptable styles of lighting (Lutzenhiser 1993; Day and Hitchings 2009, Henning 2005). According to several studies, life-stage is important in determining electricity use. Data indicates that an older age group is associated with lower overall demand, and the study by Yohanis et al. (2008) found that throughout the day

and evening, over 65 year-olds consume the smallest amount of electricity, but 50–65 year-olds consume the largest. Further analysis by Yohanis et al. (2008) found that homes with primary occupants between 50 and 65 have twice the evening electricity consumption of older occupants. Yohanis et al. (2008) observe that the 50–65 year bracket includes those with higher household incomes and those living in larger houses.

The way that electricity using practices are contextualized and embedded within household dynamics and interpersonal relations is not well documented, although their significance for patterns of consumption is recognized within practice theory literature: as for example in the observation by Hand et al. (2007:678) that interpersonal relations and the coincidence of practices make home “a restless place”.

In the following section we address this gap by exploring three themes of gender, generation and fluidity in household composition that arose inductively during analysis of our findings. These themes were identified by employing a list of thematic codes, generated collaboratively and modified iteratively by the researchers as the project progressed. Firstly, we treat material referring to the gendered nature of electricity related practices; secondly we discuss the relevance of different age groups to patterns and meanings of consumption among household members. Finally, we turn to the sometimes turbulent dynamics of household composition whereby temporary residents, together with non-residents, exert influence on how households manage electricity use. Our focus is on households composed of members who are related as through consanguineal and affinal kinship, as opposed to households composed of members who share a dwelling, but do not regard one another as kin. The latter type of household was not represented in our sample.

2. Gender, Generation and Fluidity in Kinship Based Households

We frame our findings by conceptualizing energy use as shaped through the interaction of five different core elements that together constitute social practices and the ways they are organised and distributed across space and time. We refer to this approach as the CCRES model of energy use. It is based on a socio-technical perspective (Hughes 1993; Rydin et al.2013). It also

draws on recent thinking seeking to connect actor-network theory (Law 2007) and social practice theory (Schatzki 1996; Reckwitz, 2002; Shove et al 2012) as discussed by Horta et al (2014), who note that such synergy holds out “a promising platform for new developments in energy consumption research” (117).

The five elements of the model are:

- *Conventions*: constituted by what is considered to be normal energy use, through for example standards, designs of appliances, cultural expectations and symbolic meanings.
- *Capacities*: the ability and potential for objects, artefacts, and techniques to use energy and provide energy services, constituted through their design, materiality, knowledge and craft in use.
- *Rhythms*: the multiple temporalities operating daily, weekly, monthly, annually through which activities are organised and patterned.
- *Economies*: disposition towards and management of social, natural and financial resources and investments.
- *Structures*: enduring features of the socio-material world, e.g. structures of employment, school hours, building structures and materials, systems of energy provision, family structures, household life-stages, social class.

We find it useful to envisage the model as a “gear system" with each element as a cog or gear that work together in different ways in different contexts to shape how energy is used. Relationships between the cogs is not fixed, neither is their relative “size", or influence on any given scenario. The recurrent interaction of these cogs leads to the reproduction and patterning of social practices in particular contexts, and in turn serves to embed these elements within the socio-technical systems of which they are a part.

This model elaborates on that described by Elisabeth Shove to explain the ratcheting of energy intensity across time (Shove 2003:194). When ratcheting is represented as a series of “cogs in a system of systems” (196) it signifies not only relentless escalation of energy consumption but the potential for change through interventions that might enable the “right” cog to be tuned in the “right” way (195). Shove portrays cogs as standing for any kind of element. We categorise them into five distinct categories that emerged through the analysis of our empirical data. These five

categories cannot be isolated one from another because they are united dynamically. Although, under specific circumstances, some cogs may be more influential than others, the positioning of each is always determined by the movement of others.

Further as advocated by Strengers (2013), the CCRES model embraces the messiness and instability attendant on the organisation or reorganisation of practices that use electricity in everyday life. It does not aim to eradicate mess “but to account for, understand, embrace and conceptualise it as more than a “range of factors‟ (Strengers 2013:55). For example, the model is able to connect the intersecting routines that choreograph temporal and spatial mobility in contemporary households (structures and rhythms) with the accumulation of appliances, including competency in their use (capacities and economies) that are in turn implicated with notions of accomplishment and identity (conventions).

The CCRES model also addresses Strengers‟ recent critique of the gendered nature of the “ideal and idealised individual consumer of energy” invented by promoters of new and interactive “smart” energy technologies (2013:36). Strengers dubs this fallacious figure Resource Man: “A technologically interested, gendered and highly informed micro-resource manager who is involved in managing his own consumption as well as assigning control of this management to energy utilities and smart technologies” (Strengers 2013:171). Resource Man is moreover a repackaged version of the “someone‟ behind the meter envisaged by utility managers (Patterson 1999:75). He represents the normatively masculine, individual bill payer and “head of household‟ who functions as a comforting cipher to combat the inconveniently slippery descriptions unearthed by our qualitative research.

2.1 Gender

Energy in northern industrialised countries tends to be perceived as gender neutral with women and men “regarded as equal in their use and views about energy” (Clancy 2003:44); a perspective that began to be challenged by pioneering research (Clancy et al. 2003; Roehr 2001), Clancy (2003) proposes that adopting a gendered perspective reveals new understandings about who makes decisions about which energy services. Gendered relations act as organizing principles in contexts where energy services - in our example specifically

those powered by electricity – are harnessed in the socio-technical production of contemporary domestic settings. Gender roles and their interpretation within households influence electricity uses because of cultural associations with particular services of provision (Biltman et al 2004) and energy efficiency interventions have been shown to disadvantage one gender over another, as for example research in Sweden that increased domestic workload for women .

Among our informants, household practices and provisioning appear predominantly rooted in traditional divisions of labour (Oakley 1974; Allan and Crow 1989): a likely cultural relic deriving from an economy once reliant on masculine employment in heavy industry and mining. Although not universal, gendered patterns of domestic spaces and practices were found in research visits in 61 of the 131 homes visited which provides a broad evidence base for the arguments being made here.

Despite the growing discourse of gender equality in Euro-American societies, gender differences vary from one context to the next and there is evidence of disparities between ideological expressions of gender equality on the one hand and gender as practiced on the other (Winther 2012:192). This resonates with the environmental value-action gap which proponents of practice theory argue reveals a conceptual problem with understanding how energy is used on a day to day basis (Shove, 2010). In this context, our data aligns with Winther's conclusion to suggest the presence of a gap between how gender equality is thought about and how it is practiced which clarifies how obdurately gendered domestic spaces and practices continue to be performed and reproduced in British homes. We argue that rather than being driven by consciously held attitudes and values about gender, the gendering of domestic spaces and practices is more powerfully driven by the elements of the CCRES framework. The implications of this for energy policy and smart energy initiatives which seek to unlock flexibility in demand are discussed in the conclusion.

There remains a longstanding trend for women to shoulder major responsibilities for food preparation and household chores; tasks that in the modern home are also associated with electrically powered domestic technologies, particularly so called "white" goods and cooking appliances. Men's uses of domestic technologies are predominantly associated with DIY

activities and outdoor work, such as gardening, repairs, patio cleaning or car maintenance (Jackson and Moores 1995:10-11) or with inside spaces such as garages and boiler rooms (Henning 2005:95). One of our male informants describes this pattern existing between himself and his wife as defining “our own areas of expertise”. Others told us:

> *Male: I do most of the garden as well; obviously the car you know. It's just certain jobs that I do. (MJRTL05)*
> *Male: If its generally technical my wife would let me do it. (EPJ15)*

In a study of gender and technological change Cynthia Cockburn (1985) found that even working women who use technical equipment at work see themselves as technologically illiterate at home. In our study both male and female informants similarly align women's competency in domestic production with what are viewed as “less technical” activities even though the use of a washing machine or an oven requires no more or less actual technological competency than a lawn mower or a drill. These ambivalent perspectives clearly illustrate the interaction of social and technical entities in the production of social practices. Convention engages capacity in the form of an electrically powered artefact, which in turn connects to the economy of the household resource, via the structure of electrical power, within the time-frame or rhythm, of household activities. These dynamics are vividly illustrated when our informants' conversations turn to laundry.

Laundry is an element of domestic work that has attracted considerable scholarly attention, perhaps because of its reputation as an obdurate domestic arena for performing gender. Mechanised laundry practices have become ubiquitous in homes in affluent countries over the past few decades, greatly increasing the frequency with which clothes and household textiles are laundered (Shove 2003:155). As Biltman points out “individuals demonstrate their gender identity in part through their daily use of technologies” (Biltman et al. 2004:413-14). The example of the washing machine makes this point powerfully via a sustained historical trajectory linking women with processing laundry (Malcolmson 1981).

The development of cheaper washing machines enabling them to achieve the status of ordinary items in households, even among lower income groups, has not necessarily made women's

lives easier, with mechanization serving merely “to raise cultural standards of cleanliness rather than freeing women from domestic drudgery” (Bray 2007:39-40, citing Cowan 1983). Additionally, it has been acknowledged since the 1970s that “people have more clothes now than they did in the past and wash them more often” (Vanek 1974:117).

One common strategy by which men affirm the feminizations of laundry processes and resist challenges to masculine identity posed by involvement in them (often with the collusion of their female partners) is to declare themselves redundant by dint of their own incompetency. By implication this movement valorizes their female partner's skills as a laundress, implicitly invoking an explicitly gendered role. The quotations below demonstrate how these conventions surrounding gender and technology in the home are negotiated by way of reference to ascribed competencies and temporal continuities to portray homely consensus and a mutually agreed status quo.

> *Female: Yes, I do all the washing and everything. I don't think he would know how to work it [the washing machine] anyway. I don't think you have ever worked the washer, have you?*
> *Male: Yes [meaning agreement]. (ML11)*

> *Female: Washing and ironing. They don't do washing.*
> *Male: No washing I can't. (MJRTL22)*

Ironically, given the powerful cultural equation of masculinity with technology (Wajcman 1991), women and men are prone to imagine men as alienated from laundry technologies, most particularly the washing machine, with men not having “worked out” how to use it (Speakman and Marchington 1999:96). This symbolically mediated contrivance, as illustrated by our informants, is noted in research by Speakman and Marchington, who interpret it as a form of mystification that supports the gender-differentiation of ownership of household tasks. Gender differentiation through ownership: “appears to override knowledge and ability to be able to undertake the task, in such ways that men either feign ignorance and/or incompetence, or fail to acquire the knowledge and ability” (1999:96). Results from their study of laundry practices among shift worker “breadwinners", drawn from the manufacturing sector in the North West of England, parallels our material. For example, the researchers found that if men participate this

does not destabilise the predominant understanding of laundry work as female, rather men are construed as helpers, subordinate to the skills and superior know-how of women, and rarely as initiators.

> *Female: If I said to him "I've set our washer just pop it in, put some liquid in" he'd do it. Male: Yes we have split things we wash. She [wife] thinks that I may shrink them I don't use all of the dials. I just leave it on there because majority we have is cotton or wool so I just leave it like this. (MJRTL22)*

> *Male: I don't know how to set it. She sets it …. I'd ruin my clothes. (MJRTL19)*

Whenever ownership of washing and ironing remains in a woman's sphere, men's responsibility appears to be limited and partial, creating puzzlement about when "help" might be interpreted as trespassing on their partner's territory (Speakman and Marchington 1999:99). A man's declared and mutually accepted incompetence is entangled with claims of ownership of work by a female partner in order to produce morally satisfying justifications for structuring household activities (Strengers 2013). However, these positions are not necessarily solidified into immutable conformity: being subject to modification and change when experience affords perspectives that offer new meanings. For example, the perceived feminization of ironing can be modified by experiences of ironing outside the home in a masculine environment. One of our male informants who irons his own clothes explains that he learnt to do so when serving in the military: I have a services background so I can iron.

Not only clothes, but other domestic paraphernalia are washed mechanically. In addition to bed linen, items such as curtains, soft furnishings, toys, rugs and equipment relating to pets regularly find their way to the washing machine and tumble drier. Women, thus, engage the "washer" in tandem with detergents, fabric conditioners and drying techniques, to fashion multi-sensory environments, notions of home and family identities (Pink 2005; Pink 2012). Men's role in these activities is frequently subordinate to women's in a complex nexus of strategies that shape both gender and technology (Lohan and Faulkner 2004:322).

Gendered ownership is also applicable to spaces and rooms within a household that are associated with specific practices that use electricity. Some of our female informants assert

exclusive sway in their kitchen, explaining their authority in terms of the kitchen's role as a hub for activities they consider themselves best equipped to undertake. Men's involvement in cooking can be read as interference with hallowed conventions when, as with laundry, a convenient myth of incompetency is spun.

> *Female: No never! He doesn't cook! He doesn't know how to use the cooker. He is just a mess when he come in here [kitchen]. He is just where's this, where's that? So he doesn't cook in the house. No, head shoot, no, no. I don't like him cooking in my house. (MJRTL07)*

> *Female: This is my domain. I do a lot of cooking. I do a lot of buffets for the club so I've got this on ten hours nearly a day. (ML07)*

The persistence of patterns of domestic labour with women taking the lion's share of work inside the home, despite their increased participation in the labour market, raises issues of equity and questions about why many women, “perceive the domestic division of labour to be fair, or satisfactory, despite objectively unfair distribution of work” (Baxter 2000:609). These important questions are not explored here, but Baxter's inference that change may be slow in coming is significant. As Winther (2012) notes, in her commentary on Henning's ethnography of house heating equipment in Sweden, (Henning 2005b) husbands and wives demonstrate preoccupation with performing gender roles and identities when negotiating the installation of solar collectors. Gender-differentiated tasks can hold symbolic meanings for men and women that exert strong affective influences on household dynamics with effects that lock the gearing of energy use into place.

Interactionist theorists have developed performative approaches to gender, by showing how people actively do gender and thus coproduce gendered relations (West and Zimmerman 1987; Butler 2004). In these ways men and women are mutually accountable for forming one another's gendered behavior. Johnson (2009) argues that as well as doing gender; couples harness its potential emotional force to use gender in self-consciously orchestrating their heterosexual partnerships. She proposes that: “Spouses use domestic labor as a ritualized conversation through which they exchange emotional messages regarding themselves as men and women as well as their expectations of their spouses as a man or a woman” (Johnson

2009:69). Moreover, in the process “whether intentional or not, they are „doing' gender with regards to the larger normative structure of gender” (Johnson 2009:69). Johnson's work with newly married American couples shows how transactions between men and women are emotionally tuned to collectively navigate domestic practices in the household around standard conventions. The strategies employed through collaborative identity work in pursuit of emotional goals, like the mystification encountered above, include deliberations and rationalizations that makes “illogical behavior logical” (Johnson 2009:81). These insights have further implications for the shaping of practices that use electricity, because in accord with our own observations, Johnson found emotionally motivated gender-differentiation of household tasks particularly focused around laundry and cooking.

2.2 Generation

Conventions surrounding gender are diffused across the life cycle of households. They cross-cut and are sometimes superseded by other important influences on practices that use electricity, such as those related to child-care. For households with young children, cooking/eating, cleaning, laundry and bathing are primarily organised around their needs, school and other structural routines. In households with older children, routines may be more fluid with people eating at different times, so various parallel electricity lives unfold in the same household:

> *Female: With a 16 and 19 year old … they're out all the time. … We cook when people are wanting food. (DL13)*

> *Female: I don't cook a lot anymore, with being on my own. … Usually use the microwave on the teatime. It got to the stage years ago where they all wanted different things but now they just all do their own. And usually it's, if it's a pizza they use the oven, but it's mostly microwave stuff. … He (son) doesn't eat „til really late. Sometimes I'll be going to bed at half ten and he might say “I'm going to have a meal now”. I think “How can you do it?”, but that's what he does. (GP021)*

Teenagers are figured by their parents and grandparents as profligate in their use of electricity and subversive of the household's attempts to make savings by failing to turn off lights, showering too frequently and for too long, spending long periods playing computer games and

increasing the pressures on laundry (Roehr 2001; Hargreaves et al. 2010). Both women and men report attempts to convince their children to take shorter showers and economise on hot water, echoing Gram-Hanssen's research demonstrating Scandinavian teenagers' devotion to showering (2007).

We found the presence of younger people in households combined with higher incomes to match with the penetration of digital technology. Families with two working adults and teenagers or young adult offspring were most likely to be digitizing everyday life through smart phones and other internet devices as well as participating in reconfigurations of work and education that blur boundaries between previously demarcated time-spaces. However, these trends are not restricted to this demographic. The presence of large internet connected TVs was a noticeable feature of living spaces of retired people too. We suggest these new forms of connectivity and flexible consumption – whether being able to work from anywhere, or being able to watch favourite TV shows any time – are widespread. They are disruptive of some previous structures, capacities and rhythms: for example consuming entertainment media might compromise communal family activity, but digitisation is nevertheless widely accepted and integrated into peoples' daily lives.

Separate viewing may anyway precede digitisation. We encountered older people with longstanding habits of spatially gendered routines around viewing television programmes. The carving out of personal space around broadcast content that is deemed gender specific seems to be the product of long term relationships. These couples are comfortable admitting spending regular periods of recreational time apart in the home, without fear of compromising their representation as a couple.

> *Male: When my wife is watching Coronation Street and there is a football match on, I'm in here. Female: This is his room at night. I used to sit here a lot when I was younger and knitting things. I could make a mess in here and keep that tidy but now I hardly come in here do I? So it's mostly a man's room. (MJRTL11)*

> *Male: We've got three TVs in the house. Two of them are generally on at the same time because I hate soaps …. So she'll [wife] sit and watch that one in the evening while I go upstairs and watch it. (MJRTL09)*

Gram-Hanssen suggests that the everyday life of individuals can be viewed as a “crossing point of many different practices” (2011:76). The qualitative data analysed above reinforces this observation by illustrating how practices that use electricity are junctures where individuals negotiate their relationships. Here the micro-social world of the household is created, sustained or altered by an electricity system constituted by the kinetic gearing of conventions, capacities, economies and structures. In her discussion of the role of technology as an element of practice Gram-Hanssen (2011:66) states that laundry practices are “dependent on washing machine technologies as well as systems of new fabrics”; but as we have illustrated they are also dependent on the generational mix in households and entangled with socio-cultural practices concerning identity and the performance of gender. Hence sociality is shown to be as significant as materiality in enabling or inhibiting practices that drive patterns of household electricity consumption.

2.3 Households in Flux

Miller (2010:17) argues that as a unit of analysis the household includes a social entity - often but not always a family – as well as the physical entity of a dwelling. Conceptually the household allows for analytical insights into how the size and shape of the dwelling may be implicated in constituting social relations that occur within its walls. Twenty nine percent of UK households consist of only one person (ONS 2013). Such households are not, however, always permanently under single occupancy and can include additional residents on a regular, often temporary basis. Here we feature multi-occupancy, family based households, because we are interested in discussing how relationships between members and between members and the physical space they occupy generate sociocultural contexts for practices that involve the use of electricity.

The configurations of human and non-human elements found “beneath the same roof” (as the household is colloquially understood in Britain) are hugely variable according to class, ethnicity, income and education. These factors are cross-cut by measurable trends driven by structural social and economic change with particular significance for energy systems. Of special

relevance are demographic and sociological changes affecting family size and structures of households, particularly the elasticity of multi-household families where certain members move between different households that shrink and expand circumstantially over time. Numbers of UK households containing two or more families increased by 39% in 2013 (ONS 2013). The fastest growing household type in the UK is the household containing two or more families.

Families often straggle across more than one household due to one in three marriages in the UK being a re-marriage. The extent of mobility within and between households shapes practices that use electricity in ways that are difficult to capture, because of their variety and sometimes temporary nature. At this juncture our findings evidence the impact of wider social trends relating to economic downturn, housing shortage, unemployment and the incidence of divorce on patterns of electricity consumption.

Most apparent are effects relating to an increase in the numbers of adult offspring – sometimes referred to as the “boomerang generation” – returning to live in the parental home, while others are unable to leave. Over 3.3 million people aged between 20 to 34 years of age were living with their parents in the UK in 2011 (ONS 2014), representing a 25% increase on comparable figures from 1996. Some of these adult children are parents themselves, creating three generation households. Households are thus often in flux; their composition amalgamating and re-amalgamating according to the comings and goings of members. The clearest picture of households in flux emerges from findings surrounding the “boomerang generation” (Dey and Morris 1999; Kaplan 2009), a broad analytical concept describing an “ideal type“ that provides a starting point for thinking about complex patterns of familial mobility.

Our data indicates that the extent of mobility within and between households shape electricity practices in ways difficult to capture, because of their variety and sometimes temporary nature. Responses to household electricity use in circumstances where adult sons and daughters remain rooted to their natal home are similar to those that occur when they leave and return. The key difference between households where adult offspring return and those where they simply remain is that greater degrees of disruption are likely to occur in the former due to a series of adjustments and readjustments. In both instances personal space in crowded homes is

at a premium resulting in inhabitants spending more time in bedrooms, and even bathrooms, while minimizing time in communal areas (Klocker et al. 2012:2248). The yearning for personal space amplifies the tendency for tensions to cohere around how people use electricity.

> *Male: On the top of energy usage is daughter. As soon as she goes upstairs, she puts television on. As she's getting changed, television is on. When she was off Tuesday Wednesday and I think she's got through the whole series of Friends, one, two, three (DL12)*

> *Female: [H]e's on it [computer] all the time. He's got one in his bedroom … he (son) pays for that, the internet, but he doesn't pay for anything else! No board, or gas or electric and I wonder why he doesn't move out! (ML02)*

Adult sons or daughters co-residing with parents on a permanent or semi-permanent basis tend not only to operate in separate well defined spatial zones within the home; sometimes to the point of meeting only occasionally during the course of a day, but also to construct and occupy separate time zones.

> *Male: The daughter (thirties) is upstairs. Me and my wife down here. My wife works four days a week so ... daughter works five. But when she's at home I never see her. She comes down, have her breakfast, go up, have a shower, get changed and that's it. (DL12)*

The difference between members' work patterns is a major variable that influences sociality, and hence electricity practices, in boomerang households. These structurally induced rhythms dictate the timings and extent of footfall within the home, making it difficult for members to rationalise and harmonise their electricity use. Some people reduce the potential for tension by negotiating routines that fit around household members' mobility:

> *Female: No [no shower in the morning], shower in the mid-day „cause me daughter works shifts as well, so mid-day when she goes out „cause she works in the restaurant. (GP29)*

Practices such as meal times, entertaining, showering and laundry are problematic to order because they are subject to the effects of routines extraneous to the home.

Female: We just eat when we're hungry … (Daughter) will eat about half five, six-ish, and I'll have mine any time after 3 o'clock. … I probably have a sandwich before I go to bed. (DL08)

Male: It just depends who is in [about the washing]. Because me stepdaughter works at Marks & Spencer's so she's got midweek days off, she starts at five o'clock [05:00] and finishes at three [15:00] so that kind of random pattern. (EPJ19)

Female: Microwave and toaster there. Microwave, we don't really use it much, I never cook in it, I would never dream. I mean don't get me wrong, I always keep a couple of ready meals in the freezer, sometimes our son will come home, I'm hungry mum you got anything? (MJRTL14)

These temporal zones are largely determined by contrasting work patterns, but also occur where grandparents are looking after grandchildren.

Female: When my other grandkids come they'll play on that stuff (consoles). At the moment we're living in the back room (because grandchildren are living there). The xbox, wii, … when they get their own place that'll all go. The little one is only allowed on it for now. (MJRTL04)

As the extracts reveal, our qualitative data represents perspectives from provider parents, as opposed to adult offspring, as interviewees were largely recruited from a customer database of bill payers. It demonstrates, from this vantage point at least, that electricity practices can be a serious source of intergenerational conflict over resources, with parents characterising their adult offspring as excessive consumers of electricity. Adult children living at home may make a financial contribution to cover accommodation or other costs but this may be a nominal sum towards general household expenses, and may not reflect actual costs of electricity.

Female: Yesterday my daughter put soup in the microwave, I said what you putting soup in the microwave for!? It takes just as long on the gas and it costs less. (GP23)

Female: Now at the moment I know it is on but I turn it off before I go to bed. He [son] wouldn't, he'd just put the DVD and the telly and not think about it, just leave the box on. (GP21)

Female: We had the internet cut off. I can't afford the bills anymore. So I only have the TV and Sky. I can't afford 60 odd pounds a month, it's just crippling me. I know my son watched DVDs before he goes to sleep. (GP21)

Some people attempt to diminish or resolve the potential for conflict by creating structured routines around household chores in order to better align with the flow of work patterns that complicate footfall in their household. One household in this situation strives to impose order and reduce tension by negotiating new shower routines to accommodate mobility patterns. Another seeks to organise household chores through the formality of a cleaning rota:

Male: It normally would be a weekend. ... if it's one of the [adult] kids then it would be through the week, during the day. (EPJ19)

Where extended families in single households do eat together gender inequality appears again with the eldest female householder taking responsibility for cooking (Klocker 2012:2250). Even when maintaining separate households, family homes can remain open to adult sons, daughters and grandchildren to return regularly to receive hospitality; ranging from Sunday lunches to regular meals and periodic stays. Parents may be geared to respond to the needs of their adult children with very little notice and are alert to additional responsibilities created by the existence of grandchildren.

Female: We have friends over for a weekend sometimes. And we have a son who lives down in [city] and when he comes up, that's him with his wife and two little children as well. They all come for the Sunday lunch if they're up here, everybody comes. (MJRTL09)

Male: Couple of months ago, our daughter who lives in [town name] decided to have a new kitchen fitted. And she said if we could look after the kids; two girls, sixteen and fourteen. And also do the washing for them. This was supposed to take a week but... (MJRTL09)

[INT: Could you cook your tea earlier or later than you do at the minute?] Female: No. I wouldn't do it. I couldn't do it. Na, Na. Me' grandson comes for his dinner, says "I'll be here 5:45" so I couldn't. I'm set in my ways now, I never used to be but since I had all this. (GPML04)

At the point when adult offspring leave the parental home after a temporary sojourn a transition occurs as the household reorders its energy practices to a new phase, sometimes signalling reversion to past practices.

> *Female: When [daughter] was at home she had the heating on almost all day, sat in front of the computer. Now the heating is off. I may put it on for couple of hours at night when it gets cold. (GPML01)*

> *Female: Since she's [daughter] been gone it is taking a lot longer to fill up the wash machine. (DL08)*

Our findings evidence the impact of wider social trends relating to economic downturn, housing shortage, unemployment and the incidence of divorce on patterns of electricity consumption. They indicate how the combined influences of life cycle and gender affecting electricity use within and across households are magnified as potential sources of tension when seen through the lens of shifting household composition.

3. Conclusion

Far from being havens of mono-cultural stability, domestic households are dynamic hubs, swayed simultaneously by wider structural factors and their own idiosyncratic proclivities. Households are sites of negotiations between members, and often those of other related households, towards a micro-political settlement that is only ever temporary; given that the number and kinds of participants, their kinship relations, gender, stage in the life cycle and livelihoods, together with the household's economic position and access to resources, are subject to periodic reordering. For members of households to avoid unacceptable degrees of fragmentation and resolve potential sources of tension they need to coordinate practices across different fields, a goal that tends to take precedence over altering practices merely to reduce electricity bills by relatively small amounts. This is true even where electricity costs are explicitly identified as factors that contribute to family tensions.

Given this picture it is unsurprising that research to explain variability in overall household energy consumption, or predicting flexibility in their use of electricity, produces a complex

puzzle. On the one hand, patterns of electricity use appear stable, with predictable peaks of demand. Yet between households, variability in how and when electricity is used mirrors the diversity and complexity in the make-up and management of households (DECC 2014). Households are definitively “not universal in their form” (Wheelock and Oughton 1996:156). People's willingness and ability to consume less energy or, in the case of electricity to become more adaptable in time of use, is dependent on a mosaic of internal and external circumstances; including strategies for achieving marital harmony and for child rearing, as well as fluctuating connections to livelihoods, education and recreation. Household are thus tied into the recurrent interaction of the fivefold gearing of the electricity system through their conventions, capacities, rhythms, economies and structures in different ways and with varying emphasis on each of its orchestrated cogs, depending on a households' situation at any particular moment in its life cycle.

Our portrayal of electricity use as one characterized by inconsistency, change and variability – the “messiness” discussed earlier - is too often set aside by designers and propagators of technical and economic interventions to reduce or alter patterns of domestic energy consumption. As Strengers argues even where the inadequacy of a “one size fits all” approach appears to be accepted by technocrats it is discursively reinstalled through the continued search for narrowly targeted applications that fail to embrace the true extent and depth of diversity (Strengers 2013: 39-40). Hence designers of interventions continue to ignore household heterogeneity. They rely instead on stale marketing practices based on forms of fictitious market segmentation (Hoek et al. 1996), that, despite empirical evidence to the contrary, falsely construct stability as typifying consumer's orientations and behaviour (Wright 1996) in order to profile and sort customers into simplistic typologies that appear rational and laudably scientific (Fuat Firat and Schultz 1997:188).

The reliance on models of households shows no sign of diminishing. Strengers (2013:32) argues that the opportunities presented by the advance of smart energy technologies for the exercise of demand side management is strengthening utilities' ambitions to project their own rationales, values, knowledge expertise and technologies “into the heart of the home” by harnessing the image of Resource Man, “who represents the energy industry's “resource bias'

projected onto energy consumers". But just as with older attempts at "behavior change" around electricity consumption the project is doomed to fail among the majority of householders. It avoids a focus on practices that use electricity whereby the electric current forms only one material element that is, for the most part, invisible to householders. Engaging with flows of electricity and peak demand means interventions need to be designed to acknowledge the messiness of household realities and ways that power is integrated into routines. Rather than determining consumer groups or categories of individual householders, this requires engagement with socio-material practices through which electricity is used and the negotiations and labours involved in this work. Thinking the household through its practices and the social relations and material entities of which these are composed in turn requires knowledge about what happens in homes around the use of electricity that leaves questions of attitude at the door and attends instead to the things and people who are using electricity. While this entails a considerable change in direction from current policy and industry approaches, it also opens up new possibilities for engaging people with their electricity use, empowering them to make decisions that can positively affect their well-being and financial security alongside contributing to wider objectives for environmental protection and the renewal of the electricity grid.

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